

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) An image pickup system comprising:
a block extracting ~~means~~ unit for extracting a block area with a predetermined size from a signal of an image pickup device;
a transforming ~~means~~ unit for transforming the signal in the block area extracted by the block extracting ~~means~~ unit into a signal in a frequency space;
a noise ~~estimating means~~ estimator for estimating ~~[[the]]~~ an amount of ~~noises~~ noise of a frequency component except for a zero-order component based on ~~[[the]]~~ a zero-order component in the signal in the frequency space transformed by the transforming ~~means~~ unit;
a noise reducing ~~means~~ unit for reducing ~~noises~~ noise of the frequency component except for the zero-order component based on the amount of ~~noises~~ noise estimated by the noise ~~estimating means~~ estimator; and
a compressing ~~means~~ unit for compressing the zero-order component and the frequency component except for the zero-order component from which the ~~noises are~~ noise is reduced.

2. (Currently amended) An image pickup system according to Claim 1, wherein the noise ~~estimating means~~ estimator comprises:
an obtaining ~~means~~ unit for obtaining a temperature T of an image pickup

device and a gain G of the signal;

~~giving means~~ a giving unit for ~~giving~~ providing standard values of the temperature T of the image pickup device and the gain G of the signal;

~~a coefficient calculating means~~ calculator for calculating coefficients A, B, and C based on three functions $a(T, G)$, $b(T, G)$, and $c(T, G)$ using parameters serving as the temperature T ~~given~~ provided by one of the obtaining ~~means or unit and the giving means~~ giving unit and the gain G ~~given~~ provided by one of the obtaining ~~means or unit and the giving means~~ giving unit; and

~~a noise calculating means~~ calculator for calculating an amount N of ~~noises~~ noise by using a value L of the zero-order component and the coefficients A, B, and C based on ~~[[a]] one of functional expression~~ expressions $[N = AL^B + C]$ ~~or~~ and $[N = AL^2 + BL + C]$.

3. (Currently amended) An image pickup system according to Claim 1, wherein the noise ~~estimating means~~ estimator comprises:

~~an~~ obtaining means unit for obtaining a temperature T of an image pickup device and a gain G of the signal;

~~giving means~~ a giving unit for ~~giving~~ providing standard values of the temperature T of the image pickup device and the gain G of the signal; and

a look-up table ~~means~~ unit for obtaining an amount N of ~~noises~~ noise by inputting a value L of the zero-order component, the temperature T ~~given~~ provided by one of the obtaining ~~means or unit and the giving means~~ giving unit, and the gain G given by one of the obtaining ~~means or unit and the giving means~~ giving unit.

4. (Currently amended) An image pickup system according to Claim

1, wherein the noise reducing ~~means~~ unit comprises:

an average calculating ~~means~~ unit for calculating an average of the frequency component except for the zero-order component;

an allowable range setting ~~means~~ unit for setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating ~~means~~ unit and the amount of ~~noises~~ noise estimated by the noise ~~estimating means~~ estimator; and

a correcting ~~means~~ unit for correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting ~~means~~ unit.

5. (Currently amended) An image pickup system according to Claim 4, wherein the noise reducing ~~means~~ unit further comprises:

a frequency separating ~~means~~ unit for separating the frequency component except for the zero-order component ~~every of~~ predetermined frequency band bands; and

a selecting ~~means~~ unit for selecting whether or not ~~noises are~~ noise is reduced from the frequency band separated by the frequency separating ~~means~~ unit.

6. (Currently amended) An image pickup system according to Claim 1, wherein the noise reducing ~~means~~ unit further comprises:

a threshold setting ~~means~~ unit for setting an amplitude value of the noise of the frequency component except for the zero-order component as a threshold value based on the amount of ~~noises~~ noise estimated by the noise estimating ~~means~~ unit; and

a smoothing ~~means~~ unit for reducing an amplitude component which is below

the threshold set by the threshold setting ~~means~~ unit with respect to the frequency component except for the zero-order component.

7. (Currently amended) An image pickup system according to Claim 6, wherein the noise reducing ~~means~~ unit further comprises:

a frequency separating ~~means~~ unit for separating the frequency component except for the zero-order component ~~every of~~ predetermined frequency band bands; and

a selecting ~~means~~ unit for selecting whether or not the ~~noises are~~ noise is reduced from the frequency band separated by the frequency separating ~~means~~ unit.

8. (Currently amended) An image pickup system according to Claim 1, wherein the block extracting ~~means~~ unit comprises a chart separating ~~means~~ unit for separating a part corresponding to a gray chart from the signal obtained by picking-up an image for correction including at least three types ~~or more~~ of gray charts with different reflectances by the image pickup device, and

the transforming ~~means~~ unit transforms the part corresponding to the gray chart separated by the chart separating ~~means~~ unit into the signal in the frequency space, and

the image pickup system further comprises:

a variance calculating ~~means~~ unit for calculating a variance N of the frequency component except for the zero-order component of the corresponding part of the gray chart; and

a fitting ~~means~~ unit for calculating coefficients A, B, and C based ~~on a one of~~ functional ~~formula of~~ formulae $N = AL^B + C$ ~~or~~ and $N = AL^2 + BL + C$ ~~by~~ using a

value L of the zero-order component and the variance N.

9. (Currently amended) An image pickup system according to Claim 8, further comprising:

a coefficient storing ~~means~~ unit for storing the coefficients A, B, and C calculated by the fitting ~~means~~ unit.

10. (Currently amended) A replay system for processing a signal compressed after transformation to a signal in a frequency space, comprising:

a decompressing ~~means~~ unit for decompressing the signal to the signal in the frequency space;

a noise estimating ~~means~~ unit for estimating the amount of ~~noises~~ noise of a frequency component except for a zero-order component based on the zero-order component in the signal in the frequency space decompressed by the decompressing ~~means~~ unit;

a noise reducing ~~means~~ unit for reducing ~~noises~~ noise of the frequency component except for the zero-order component based on the amount of ~~noises~~ noise estimated by the noise estimating ~~means~~ unit; and

an inverting transforming ~~means~~ unit for transforming the zero-order component and the frequency component except for the zero-order component from which the ~~noises are~~ noise is reduced into a signal in a real space.

11. (Currently amended) A replay system according to Claim 10, wherein the noise estimating ~~means~~ unit comprises:

an obtaining ~~means~~ unit for obtaining a temperature T of an image pickup device and a gain G of the signal;

~~a giving means~~ giving unit for ~~giving providing~~ standard values of the temperature T of the image pickup device and the gain G of the signal;

a coefficient calculating means unit for calculating coefficients A, B, and C based on three functions $a(T, G)$, $b(T, G)$, and $c(T, G)$ using parameters serving as the temperature T given by one of the obtaining ~~means or unit and~~ the ~~giving means giving unit~~ and the gain G given by one of the obtaining ~~means or unit and~~ the ~~giving means giving unit~~; and

a noise calculating means unit for calculating an amount N of ~~noises noise~~ by using a value L of the zero-order component and the coefficients A, B, and C based on ~~[[a]] one of the functional expression expressions~~ $[N = AL^B + C]$ ~~or and~~ $[N = AL^2 + BL + C]$.

12. (Currently amended) A replay system according to Claim 10, wherein the noise estimating ~~means unit~~ comprises:

an obtaining means unit for obtaining a temperature T of an image pickup device and a gain G of the signal;

~~giving means~~ a giving unit for ~~giving providing~~ standard values of the temperature T of the image pickup device and the gain G of the signal; and

a look-up table means unit for obtaining an amount N of ~~noises noise~~ by inputting a value L of the zero-order component, the temperature T given by one of the obtaining ~~means or unit and~~ the ~~giving means giving unit~~, and the gain G given by one of the obtaining ~~means or unit and~~ the ~~giving means giving unit~~.

13. (Currently amended) A replay system according to Claim 10, wherein the noise reducing ~~means unit~~ comprises:

an average calculating means unit for calculating an average of the frequency

component except for the zero-order component;

a allowable range setting ~~means~~ unit for setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated by the average calculating ~~means~~ unit and the amount of ~~noises~~ noise estimated by the noise estimating ~~means~~ unit; and

a correcting ~~means~~ unit for correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set by the allowable range setting ~~means~~ unit.

14. (Currently amended) A replay system according to Claim 13, wherein the noise reducing ~~means~~ unit further comprises:

a frequency separating ~~means~~ unit for separating the frequency component except for the zero-order component ~~every of~~ predetermined frequency ~~band~~ bands; and

a selecting ~~means~~ unit for selecting whether or not ~~noises are~~ noise is reduced from the frequency band separated by the frequency separating ~~means~~ unit.

15. (Currently amended) A replay system according to Claim 10, wherein the noise reducing ~~means~~ unit comprises:

a threshold setting ~~means~~ unit for setting an amplitude value of the noise of the frequency component except for the zero-order component as a threshold value based on the amount of ~~noises~~ noise estimated by the noise estimating ~~means~~ unit; and

a smoothing ~~means~~ unit for reducing an amplitude component which is below the threshold set by the threshold setting ~~means~~ unit with respect to the frequency component except for the zero-order component.

16. (Currently amended) A replay system according to Claim 15, wherein the noise reducing ~~means~~ unit further comprises:

a frequency separating ~~means~~ unit for separating the frequency component except for the zero-order component ~~every of~~ predetermined frequency band bands; and

a selecting ~~means~~ unit for selecting whether or not the ~~noises are~~ noise is reduced from the frequency band separated by the frequency separating ~~means~~ unit.

17. (Currently amended) An image pickup program ~~executed~~ stored in a machine readable medium for execution by a computer, comprising the steps of:

a) ~~a block extracting step of~~ extracting a block area ~~with of~~ a predetermined size from a signal ~~[[of]]~~ provided by an image pickup device;

b) ~~a transforming step of~~ transforming the signal in the block area extracted ~~by the block extracting in~~ step (a) into a signal in a frequency space;

c) ~~a noise estimating step of~~ estimating ~~[[the]]~~ an amount of ~~noises of~~ noise in a frequency component except for a zero-order component based on the zero-order component in the signal in the frequency space transformed ~~by the transforming at~~ step (b);

d) ~~a noise reducing step of~~ reducing ~~noises of~~ noise in the frequency component except for the zero-order component based on the amount of ~~noises~~ noise estimated ~~by the noise estimating at~~ step (c); and

e) ~~a compressing step of~~ compressing the zero-order component and the frequency component except for the zero-order component from which the ~~noises are~~ noise is reduced.

18. (Currently amended) An image pickup program according to Claim 17, wherein ~~the noise-reducing step~~ (d) further comprises:

f) ~~an average-calculating step of~~ calculating an average of the frequency component except for the zero-order component;

g) ~~an allowable-range-setting step of~~ setting an upper limit value and a lower limit value of the frequency component except for the zero-order component based on the average calculated ~~by the average-calculating~~ at step (f) and the amount of noises noise estimated ~~by the noise-estimating~~ at step (c); and

h) ~~a correcting step of~~ correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set ~~by the allowable-range-setting~~ at step (g).

19. (Currently amended) An image pickup program according to Claim 17, wherein ~~the block-extracting step~~ (a) further comprises: ~~a chart-separating step of~~

f) separating a part corresponding to a gray chart from the signal obtained by picking-up an image for correction including at least three types ~~or more~~ of gray charts with different reflectances by an image pickup device, and

~~the transforming step (b)~~ transforms the part corresponding to the gray chart separated ~~by the chart-separating~~ at step (f) into the signal in the frequency space, and

the image pickup program further comprises the steps of:

g) ~~a variance-calculating step of~~ calculating a variance N of the frequency component except for the zero-order component of the corresponding part of the gray chart; and

~~h) a fitting step of calculating coefficients A, B, and C based on one of [[a]] functional formula formulae of $N = AL^B + C$ or and $N = AL^2 + BL + C$ by using a value L of the zero-order component and the variance N.~~

20. (Currently amended) A replay program stored in a machine readable medium for execution by a computer, comprising the steps of:

~~a) a decompressing step of decompressing, into a signal in a frequency space, a signal compressed after [[the]] transformation as [[the]] a signal in the frequency space;~~

~~b) a noise estimating step of estimating [[the]] an amount of noises of noise in the frequency component except for the zero-order component based on the zero-order component of the signal in the frequency space decompressed by the decompressing at step (a);~~

~~c) a noise reducing step of reducing the noises noise of the frequency component except for the zero-order component based on the amount of noises noise estimated by the noise estimating at step (b); and~~

~~d) an inverting transforming step of transforming the zero-order component and the frequency component except for the zero-order component from which the noises are noise is reduced into a signal in a real space.~~

21. (Currently amended) A replay program according to Claim 20, wherein ~~the noise reducing step (c) further~~ comprises:

~~e) an average calculating step of calculating an average of the frequency component except for the zero-order component;~~

~~f) an allowable range setting step of setting an upper limit value and a lower limit value of the frequency component except for the zero-order component~~

Applicant: Takao Tsuruoka
Application No.: 10/530,085

based on the average calculated ~~by the average calculating at~~ step (e) and the amount of noises noise estimated ~~by the noise estimating at~~ step (b); and

g) ~~a correcting step of~~ correcting the frequency component except for the zero-order component based on the upper limit value and the lower limit value set ~~by the allowable range setting at~~ step (f).